(19)日本国特許庁（ＪＰ）　(12)公表特許公報（Ａ）　(11)特許出願公表番号
特表2002－542513
（Ｐ2002－542513Ａ）
(43)公表日　平成14年12月10日(2002.12.10)

(51)Int.Cl.[7]		識別記号	FI		テーマコード(参考)
G02F	1/13357		G02F	1/13357	2H091
	1/133	535, 580		1/133 535, 580	2H093, 5C094
	1/19			1/19	5G435
G09F	9/00	324	G09F	9/00 324	

審査請求　未請求　予備審査請求　未請求(全 13 頁)　最終頁に続く

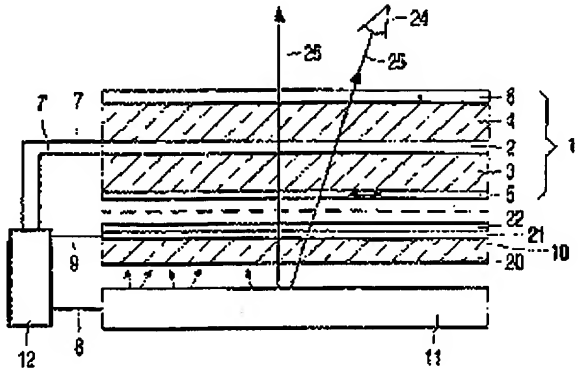
(21)出願番号　特願2000－612798(Ｐ2000－612798)
(86)(22)出願日　平成12年４月12日(2000.4.12)
(85)翻訳文提出日　平成12年12月20日(2000.12.20)
(86)国際出願番号　ＰＣＴ／ＥＰ００／０３２６９
(87)国際公開番号　ＷＯ００／６３７４５
(87)国際公開日　平成12年10月26日(2000.10.26)
(31)優先権主張番号　９９２０１２１３．８
(32)優先日　平成11年４月20日(1999.4.20)
(33)優先権主張国　欧州特許庁（ＥＰ）
(81)指定国　ＥＰ(ＡＴ，ＢＥ，ＣＨ，ＣＹ，ＤＥ，ＤＫ，ＥＳ，ＦＩ，ＦＲ，ＧＢ，ＧＲ，ＩＥ，ＩＴ，ＬＵ，ＭＣ，ＮＬ，ＰＴ，ＳＥ)，ＣＮ，ＪＰ

(71)出願人　コーニンクレッカ　フィリップス　エレクトロニクス　エヌ　ヴィ
Ｋｏｎｉｎｋｌｉｊｋｅ　Ｐｈｉｌｉｐｓ　Ｅｌｅｃｔｒｏｎｉｃｓ　Ｎ．Ｖ．
オランダ国　５６２１　ベーアー　アインドーフェン　フルーネヴァウツウェッハ　１
Ｇｒｏｅｎｅｗｏｕｄｓｅｗｅｇ　１，５６２１　ＢＡ　Ｅｉｎｄｈｏｖｅｎ，Ｔｈｅ　Ｎｅｔｈｅｒｌａｎｄｓ
(72)発明者　ヒューゴ　イェー　コルネリッセン
オランダ国　５６５６　アーアー　アインドーフェン　プロフ　ホルストラーン　６
(74)代理人　弁理士　杉村　興作　（外１名）

最終頁に続く

(54)【発明の名称】　透過／反射切換え型表示装置

(57)【要約】
透過／反射切換え型表示装置は、透過状態と反射状態との間で切換えうる透過／反射切換え器（１０）を有する。この透過／反射切換え器としては、金属水素化物の光学スイッチを用いるのが好ましい。



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【特許請求の範囲】

【請求項１】　第１の透明基板と第２の透明基板との間に電気光学材料を有する透過／反射切換え型表示装置であって、前記第２の透明基板の側に照明装置が設けられている当該透過／反射切換え型表示装置において、

前記照明装置と前記電気光学材料との間に切換え可能なミラーが配置され、このミラーは透過状態と、電気光学材料の方向に光を反射させる反射状態との間で切換えうるようになっていることを特徴とする透過／反射切換え型表示装置。

【請求項２】　請求項１に記載の透過／反射切換え型表示装置において、前記切換え可能なミラーは透過状態で少なくとも４０％の光を透過するようになっていることを特徴とする透過／反射切換え型表示装置。

【請求項３】　請求項１に記載の透過／反射切換え型表示装置において、前記切換え可能なミラーには、水素とで水素化物を構成しうる三価の金属を有する切換え可能な層が設けられ、この層は、水素の交換により反射状態と透過状態との間で可逆的に切換えうるようになっていることを特徴とする透過／反射切換え型表示装置。

【請求項４】　請求項３に記載の透過／反射切換え型表示装置において、前記切換え可能な層がマグネシウムをも有することを特徴とする透過／反射切換え型表示装置。

【請求項５】　請求項４に記載の透過／反射切換え型表示装置において、前記切換え可能なミラーが透過状態で少なくとも６５％の光を透過するようになっていることを特徴とする透過／反射切換え型表示装置。

【請求項６】　請求項３に記載の透過／反射切換え型表示装置において、前記切換え可能な層には、パラジウム、プラチナ、コバルト及びニッケルの群のうちの少なくとも１つの金属を有する触媒活性層が設けられていることを特徴とする透過／反射切換え型表示装置。

【請求項７】　請求項１に記載の透過／反射切換え型表示装置において、前記電

示装置及び前記照明装置が、前記切換え可能な層の切換えと、前記照明装置の切換えとを結合させる手段を具えていることを特徴とする透過／反射切換え型表示装置。

【発明の詳細な説明】

【０００１】

本発明は、第１の透明基板と第２の透明基板との間に電気光学材料を有する透過／反射切換え型表示装置であって、前記第２の透明基板の側に照明装置が設けられている当該透過／反射切換え型表示装置に関するものである。

【０００２】

このような表示装置、特に液晶表示装置は、益々広く用いられるようになってきており、例えば、携帯電話や、自動車分野等に用いられている。

【０００３】

透過／反射切換え型（transflective）表示装置は通常、透過状態（“夜間モード”と称される）で用いた場合に表示装置の後ろ側に配置したバックライトからの光を部分的に透過し、反射状態（“日中モード”と称される）で用いた場合に入射光を反射する透過／反射切換え器（transflector）を有する。

【０００４】

通常の透過／反射切換え器では、反射は入射光の約６５％であり、バックライトからの光の約３５％のみが透過／反射切換え器を通過する。この場合、多大なエネルギーを必要とするとともにバッテリの寿命を低減させる明るい光源を選択しない限り、輝度が犠牲となる。“夜間モード”で透過量を増大させると、“日中モード”において輝度及びコントラストが犠牲となる。

【０００５】

本発明の目的は、特に、上述した問題に対する解決策を見いだすことにある。この目的のために、本発明による透過／反射切換え型表示装置においては、前記照明装置と前記電気光学材料との間に切換え可能なミラーが配置され、このミラーは透過状態と、電気光学材料の方向に光を反射させる反射状態との間で切換えうるようになっていることを特徴とする。

【０００６】

逆的に切換えうるようになっていることを特徴とする。

【０００７】

前記切換え可能な層は、水素化物を構成しうるマグネシウムをも有するのが好ましい。このような層によれば、少なくとも７５％、ある場合には８５％～９０％の反射率が得られ、これらの層は、光の８０％～９０％を透過させる透過状態に（１～１０秒の範囲内で）切換えうることを確かめた。切換え可能な層には、必要に応じ、パラジウム、プラチナ、コバルト及びニッケルの群のうちの少なくとも１つの金属を有する触媒活性層を設ける。

【０００８】

本発明による透過／反射切換え型表示装置の第２の例においては、前記切換え可能な層を、液体の電解質、ゲルの電解質又は固体の電解質と接触させる。これらの電解質の例は、水中の１モルＫＯＨ、シンメトリックコリジン中の１モルトリフルオル酢酸又は酸化セリウム（CeO_2）である。

【０００９】

特に有利な例によれば、切換え可能なミラー及び照明装置を結合的に（例えば同時に）切換える。

【００１０】

本発明の上述した観点及びその他の観点は以下の実施例に関する説明から明らかとなるであろう。

図面は線図的なものであって、実際のものに正比例して描いていない。各図間で対応する素子には同じ符号を付してある。

図１及び２は、表示装置、本例では液晶表示装置の一部分の線図的断面図であり、この装置は本例では、例えば電極（図示せず）が設けられたガラスより成る２つの透明基板３、４間に存在するねじれネマチック液晶材料２を有する液晶セル１を具える。液晶表示装置は更に偏光子５、６を有し、これら偏光子の偏光方向は例えば、互いに直交している。液晶表示装置は更に配向層（図示せず）をも

画成されている。

【００１１】

本例では、互いに交差しこれら交点の領域で画素を規定している、例えばＩＴＯ（インジウム錫酸化物）より成る透明電極（図示せず）に駆動電圧を与える必要がある。図１の実施例では、駆動回路１２により線図的に示す駆動ライン７、７′を介して電極に駆動電圧を与える。図１の装置は、駆動回路１２により線図的に示す駆動ライン８を介して駆動される照明源１１をも有する。

【００１２】

本発明によれば、照明源１１と液晶セル１との間に切換え可能なミラー１０が存在する。その最も簡単な例では、ミラー１０は、例えば、石英ガラスより成る透明基板２０と、金属Ｙ又はGdより成る、本例では、Gdより成る切換え可能な層２１とを有し、層２１には薄肉（約５ｎｍ）のパラジウム層２２が被覆されている。このような切換え可能な層は、米国特許第 5,652,433号明細書に詳細に説明されている。この米国特許明細書で説明されているように、層（GdH_2）はその製造後に鏡面状の面を有し、透明とはなっていない。表示装置１を通過する入射光２３（図２）はミラー１０で反射され、視聴者２４によって見られる。層２１を水素に当てると、この層は透光性の層（GdH_3）に変化する。従って、照明源１１から生じる光ビーム２５はミラー１０を通過し、視聴者２４に達する。この光の通過及び反射は水素の交換により反転しうる。

【００１３】

水素原子は種々の方法で、例えば気相から又は電気化学的な発生により層２１に加えることができる。しかし、電気的に切換えうる層を用いるのが好ましい。本例では、駆動ライン９を介してミラーを透明とするのと同時に駆動ライン８を介して照明源１１をスイッチオンさせる。又、駆動ライン９を介して、ミラーを不透明にするのと同時に、駆動ライン８を介して、照明源１１をスイッチオフさせる。

層２１としての$Gd_{0.4}Mg_{0.6}H_x$（０．８＜ｘ＜２．４）の第１電極と、（本例では）厚さを約５ｎｍとしたパラジウム層２２と、固体電解質$Ta_2O_5 \cdot nH_2O$の厚肉層２６と、（本例では）厚さを約３５０ｎｍとした透明H_xWO_3（０＜ｘ＜０．５）の第２電極２７と、導電性透明ＩＴＯ層２８とを有する。層２１は反射状態と透過状態との間で切換りうるも、他の全ての層は透明である。

【００１５】

図３の層の積層体は以下のように機能する。層２１及び２８は外部電流源（例えば、駆動回路１２内に設けられている）に接続されている。第１電極２１における陰極直流電流を用いることにより、低水素含有反射性（鏡面状）組成が透明の高水素含有組成に変換される。これと同時に、第２電極２７のH_xWO_3が透明のWO_3に変換される。従って、ミラー１０が透明となる。電流を反転させると、再び最初の状態になる。透過状態に切換えるための切換え時間は１～１０秒程度である。反射状態への切換えにはより多くの時間がかかるも、これは通常のものに適応するには充分に高速である。

【００１６】

図３のミラーの他の実施例及びこのミラーに対して適した材料（例えば、パラジウムの代りにプラチナ、コバルト又はニッケルを用いること、幾つかの水素含有導体、切換え可能な層の材料等）の更なる説明に関しては、国際公開パンフレットＷＯ９８／１０３２９（特表平１１－５１４７５９）を参照しうる。

【００１７】

図３に示すミラーを有する図１及び２に示す表示装置では、８０～９０％の反射率が達成された。ミラーは少なくとも４０％の透過率を有するも、この透過率は、特にパラジウム層を省略した場合に、８０～９０％まで増大させることができる。

【００１８】

本発明は図示の実施例に限定されないこと勿論である。前述したように、切換

る。電流源を有する切換え機構とは完全に異なる切換え機構も含まれる。更に、水素交換機構に応じて切換えを行なわないミラー、例えば、切換え可能な錫層も用いうる。表示装置に対しては、液晶効果の代りに電気泳動効果のような電気光学効果を用いることができる。

【００１９】

要するに、本発明は、透過／反射切換え器が透過状態と反射状態との間で切換え可能な層を有している透過／反射切換え型の表示装置に関するものである。

本発明は、各新規な特徴及びこれらの種々の組合せにある。

【図面の簡単な説明】

【図１】　本発明による表示装置の一状態を示す。

【図２】　本発明による表示装置の他の状態を示す。

【図３】　切換え可能な層の変形例を示す。

【図１】

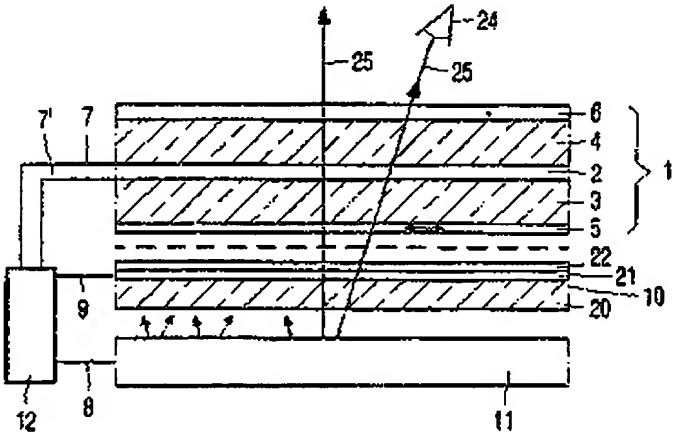

FIG. 1

【図２】

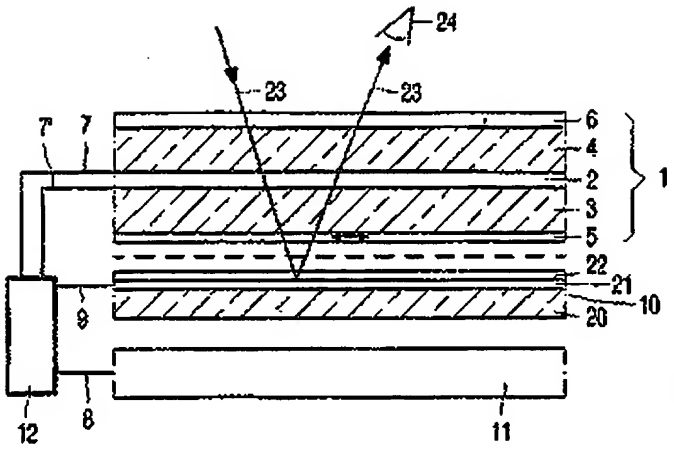

FIG. 2

【図３】

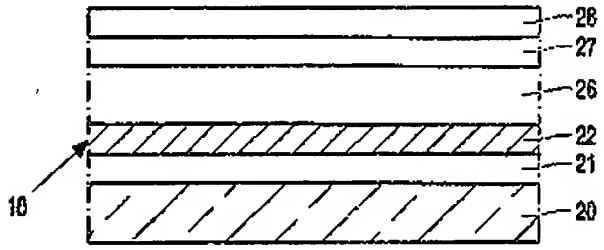

FIG. 3

【国際調査報告】

INTERNATIONAL SEARCH REPORT

Inte ernat Application No
PCT/EP 00/03269

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02F1/1335 G02F1/13357 G02F1/19 G02F1/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
WPI Data, PAJ, IBM-TDB, EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 98 10329 A (PHILIPS ELECTRONICS NV ;PHILIPS NORDEN AB (SE)) 12 March 1998 (1998-03-12) cited in the application the whole document	2-6

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[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex

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Date of the actual completion of the international search	Date of mailing of the international search report
7 August 2000	14/08/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Stang, I

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http://www4.ipdl.ncipi.go.jp/tjcontentdben.ipdl?N0000=21&N0400=image/gif&N0401=/NSAPITMP/we... 9/14/2005

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Int. Application No
PCT/EP 00/03269

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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US 5808711 A	15-09-1998	NONE	

Form PCT/ISA/210 (patent family annex) July 1992

JP,2002-542513,A ◉ STANDARD ○ ZOOM-UP ROTATION No Rotation ☐ REVERSAL

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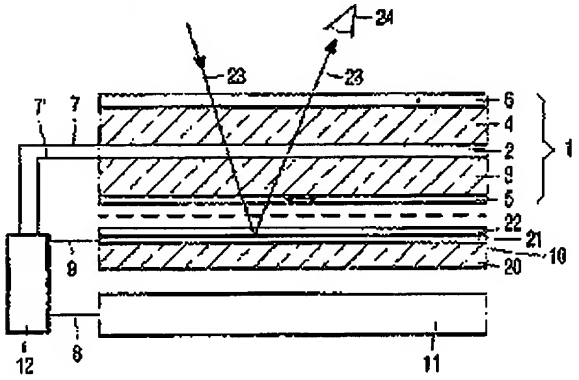
フロントページの続き

(51)Int.Cl.'		識別記号	F I		テーマコード(参考)
G09F	9/00	336	G09F	9/00	336Z
	9/35			9/35	

(72)発明者 マルティン アウヴェルケルク
オランダ国 5656 アーアー アインドーフェン プロフ ホルストラーン 6
(72)発明者 ピーター アー ダイン
オランダ国 5656 アーアー アインドーフェン プロフ ホルストラーン 6

Fターム(参考) 2H091 FA14Z FA41Z FB06 FD06
GA11 LA16 LA30
2H093 NC42 NC90 ND02 ND39 NE06
5C094 AA01 AA51 BA43 GA10
5G435 AA01 BB12 BB15 BB16 EE22
EE23 EE26 FF03 FF08 GG10

【要約の続き】



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CLAIMS

[Claim(s)]

[Claim 1] In the transparency/reflective change mold display concerned with which it is transparency/reflective change mold display which has an opto electronics material, and the lighting system is formed between the 1st transparence substrate and the 2nd transparence substrate at said 2nd transparence substrate side It is transparency/reflective change mold display which the mirror which can be switched between said lighting systems and said opto electronics materials is arranged, and is characterized by the ability to switch this mirror now between a transparency condition and the reflective condition of reflecting light in the direction of an opto electronics material.

[Claim 2] It is transparency/reflective change mold display characterized by the mirror in which said change is possible penetrating at least 40% of light in the state of transparency in transparency/reflective change mold display according to claim 1.

[Claim 3] It is transparency/reflective change mold display characterized by to prepare the layer which has the trivalent metal which can constitute a hydride from hydrogen to the mirror in which said change is possible, and which can be switched, and to be able to switch this layer now reversibly between a reflective condition and a transparency condition by exchange of hydrogen in transparency/reflective change mold display according to claim 1.

[Claim 4] Transparency/reflective change mold display characterized by the layer in which said change is possible having magnesium in transparency/reflective change mold display according to claim 3.

[Claim 5] Transparency/reflective change mold display characterized by the mirror in which said change is possible penetrating at least 65% of light in the state of transparency in transparency/reflective change mold display according to claim 4.

[Claim 6] Transparency/reflective change mold indicating equipment characterized by preparing the catalytic activity layer which has palladium, platinum, cobalt, and at least one metal in the group of nickel in the layer in which said change is possible in transparency/reflective change mold indicating equipment according to claim 3.

[Claim 7] Transparency/reflective change mold display characterized by said opto electronics material having the liquid crystal ingredient in transparency/reflective change mold display according to claim 1.

[Claim 8] Transparency/reflective change mold display characterized by equipping this display and said lighting system with a means to combine the change of the layer in which said change is possible, and the change of said lighting system, in transparency/reflective change mold display according to claim 1.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

This invention relates to the transparency/reflective change mold display concerned with which it is transparency/reflective change mold display which has an opto electronics material, and the lighting system is formed between the 1st transparence substrate and the 2nd transparence substrate at said 2nd transparence substrate side.

[0002]

Such a display, especially a liquid crystal display are used widely increasingly, for example, are used for the cellular phone, the automobile field, etc.

[0003]

Transparency/reflective change mold (transflective) display has transparency/reflective change machine (transflector) which reflects incident light, when the light from the back light arranged to the backside of a display when it uses in the state of transparency (called "night mode") is penetrated partially and is usually used in the state of reflection (called "Japan-China mode").

[0004]

With the usual transparency/reflective change vessel, reflection is about 65% of incident light, and about 35% of the light from a back light passes transparency/reflective change machine. In this case, while needing great energy, unless the bright light source which reduces the life of a dc-battery is chosen, brightness falls victim. If the amount of transparency is increased by "night mode", in "Japan-China mode", brightness and contrast will fall victim.

[0005]

Especially the purpose of this invention is to find out the solution over the problem mentioned above. For this purpose, the mirror which can be switched between said lighting systems and said opto electronics materials is arranged in

transparency/reflective change mold display by this invention, and it is characterized by the ability to switch this mirror now between a transparency condition and the reflective condition of reflecting light in the direction of an opto electronics material.

[0006]

In the 1st example of transparency/reflective change mold display by this invention, it is characterized by preparing the layer which has the trivalent metal which can constitute a hydride from hydrogen and which can be switched in the mirror in which said change is possible, and being able to switch this layer now to it reversibly between a reflective condition and a transparency condition by exchange of hydrogen.

[0007]

As for the layer in which said change is possible, it is desirable to also have magnesium which can constitute a hydride. According to such a layer, at least 75%, in a certain case, 85% - 90% of reflection factor was obtained, and these layers confirmed that it could switch to the transparency condition of making 80% - 90% of light penetrating (within the limits of 1 - 10 seconds). The catalytic activity layer which has palladium, platinum, cobalt, and at least one metal in the group of nickel is prepared in the layer which can be switched if needed.

[0008]

In the 2nd example of transparency/reflective change mold display by this invention, the layer in which said change is possible is contacted to the electrolyte of a liquid, the electrolyte of gel, or a solid electrolyte. The example of these electrolytes is the one-mol trifluoroacetic acid or cerium oxide (CeO_2) in underwater 1 mol KOH and a symmetric collidine.

[0009]

According to the advantageous example, the mirror and lighting system which can be switched are especially switched in association (to for example, coincidence).

[0010]

The viewpoint which this invention mentioned above, and other viewpoints will become clear from the explanation about the following examples.
It is in direct proportion to an actual thing, and is not drawn. [a drawing]
[diagram] The same sign is given to the component which corresponds between each drawing.
Drawing 1 and 2 are some diagram-sectional views of a liquid crystal display in a display and this example, and this equipment is equipped with two transparence substrates 3 which consist of the glass with which the electrode (not shown) was prepared, for example, and the liquid crystal cell 1 which has the torsion nematic liquid crystal ingredient 2 which exists among four by this example. A liquid crystal display has polarizers 5 and 6 further, and the polarization direction of these polarizers lies at right angles mutually, for example. A liquid crystal display also has an orientation layer (not shown) further, and orientation of these orientation layer is carried out so that it may have angle of torsion whose cel is 90 degrees in this example about the liquid crystal ingredient on the wall of a substrate. In this case, a liquid crystal ingredient has forward optical anisotropy and a forward forward dielectric anisotropy. The cel 1 is formed by the cell wall (not shown) or the closure edge.
[0011]
It crossed mutually, and the field of these intersections has prescribed the pixel, for example, it is necessary to give driver voltage to the transparent electrode (not shown) which consists of ITO (indium stannic acid ghost) in this example. In the example of drawing 1 , driver voltage is given to an electrode through drive Rhine 7 shown in diagram by the drive circuit 12, and 7'. The equipment of drawing 1 also has the source 11 of lighting driven through drive Rhine 8 shown in diagram by the drive circuit 12.
[0012]
According to this invention, the mirror 10 which can be switched between the source 11 of lighting and a liquid crystal cell 1 exists. A mirror 10 has the transparence substrate 20 which consists of quartz glass, and the layer 21 which

consists of Gd in this example which consists of Metal Y or Gd and which can be switched, and the light-gage (about 5nm) palladium layer 22 is covered with the easiest example by the layer 21. The layer in which such a change is possible is explained to the U.S. Pat. No. 5,652,433 specification at the detail. A layer (GdH2) has a mirror plane-like side after that manufacture, and does not serve as transparence as explained by this United States Patent specification. It is reflected by the mirror 10 and the incident light 23 (drawing 2) which passes a display 1 is looked at by the viewer 24. If a layer 21 is applied to hydrogen, this layer will change to the layer (GdH3) of translucency. Therefore, the light beam 25 produced from the source 11 of lighting passes a mirror 10, and reaches a viewer 24. Passage and reflection of this light can be reversed by exchange of hydrogen.

[0013]

Hydrogen atoms are various approaches, for example, can be added to a layer 21 according to electrochemical generating from a gaseous phase. However, it is desirable to use the layer which can be switched electrically. Making a mirror transparent through drive Rhine 9 and coincidence are made to carry out switch-on of the source 11 of lighting through drive Rhine 8 in this example. Moreover, making a mirror opaque and coincidence are made to carry out switch-off of the source 11 of lighting through drive Rhine 8 through drive Rhine 9.

[0014]

The mirror 10 which can be switched to such an electric target is shown in drawing 3 . The 1st electrode of Gd0.4 Mg0.6 Hx (0.8< x<2.4) as a layer 21 which this mirror can switch [which set thickness to about 200nm with the transparence (glass) substrate 20 (this example)], (this example) It has the palladium layer 22 which set thickness to about 5nm, the heavy-gage layer 26 of solid electrolyte Ta2 O5 and nH2 O, the 2nd electrode 27 of the transparence Hx WO3 (0< x<0.5) which set thickness to about 350nm (this example), and the conductive transparence ITO layer 28. All other layers of a layer 21 are [that it may switch between a reflective condition and a transparency condition]

transparent.

[0015]

The layered product of the layer of drawing 3 functions as follows. Layers 21 and 28 are connected to the external current source (for example, prepared in the drive circuit 12). By using a cathode direct current in the 1st electrode 21, a low hydrogen content reflexibility (shape of mirror plane) presentation is changed into the high hydrogen content presentation of transparence. It can come, simultaneously is Hx WO3 of the 2nd electrode 27. WO3 of transparence It is changed. Therefore, a mirror 10 serves as transparence. If a current is reversed, it will be in the first condition again. The switching time for switching to a transparency condition is about 1 - 10 seconds. more time amount [change / in the reflective condition] -- also starting -- this is fully high-speed to it being adapted for the usual thing.

[0016]

About the further explanation of the ingredients (for example, using platinum, cobalt, or nickel instead of palladium, some hydrogen content a conductor, the ingredient of the layer which can be switched, etc.) which were suitable to other example and this mirror of a mirror of drawing 3 , the international public presentation pamphlet WO 98/10329 (Patent Publication Heisei 11-514759) can be referred to.

[0017]

In the display shown in drawing 1 which has the mirror shown in drawing 3 , and 2, 80 - 90% of reflection factor was attained. When ** in which a mirror has at least 40% of transmission, and especially this transmission omit a palladium layer, they can be increased to 80 - 90%.

[0018]

this invention is not limited to the example of illustration -- it is natural. As mentioned above, other various ingredients like a liquid electrolyte (for example, underwater 1 mol KOH), a gel electrolyte (for example, one-mol trifluoroacetic acid in a symmetric collidine), or a solid electrolyte (for example, cerium oxide

(CeO2)) are possible to the mirror which can be switched. A completely different change device from the change device in which it has a current source is also included. Furthermore, the mirror which does not switch according to a hydrogen exchange style, for example, the tin layer which can be switched, can be used. To a display, the electro-optical effect like an electrophoretic effect can be used instead of the liquid crystal effectiveness.

[0019]

In short, this invention relates to the display of transparency/reflective change mold which has the layer which transparency/reflective change machine can switch between a transparency condition and a reflective condition.

this invention -- each -- it is in new descriptions and these various combination.

[Brief Description of the Drawings]

[Drawing 1] One condition of the display by this invention is shown.

[Drawing 2] Other conditions of the display by this invention are shown.

[Drawing 3] The modification of the layer which can be switched is shown.

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DRAWINGS

[Drawing 1]

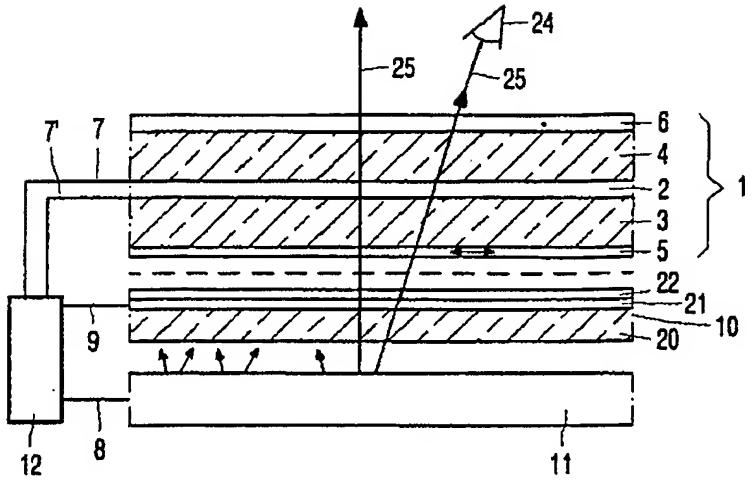

FIG. 1

[Drawing 2]

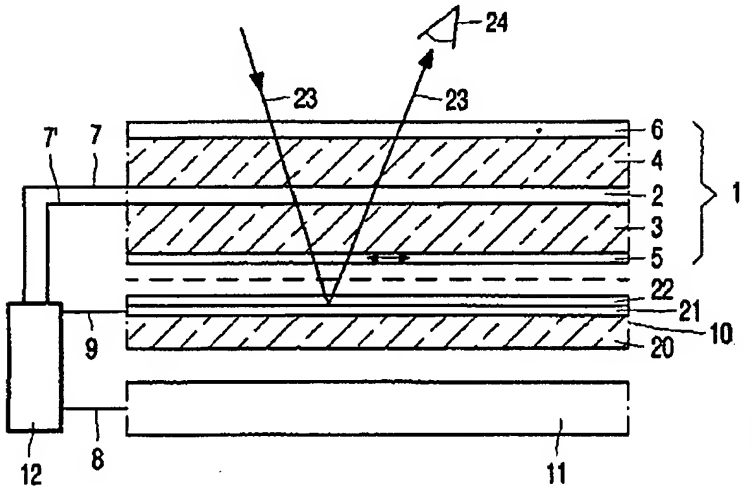

FIG. 2

[Drawing 3]

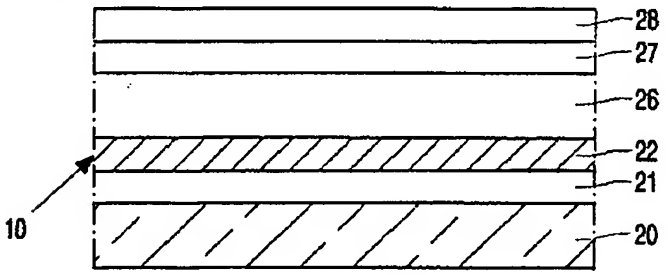

FIG. 3

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